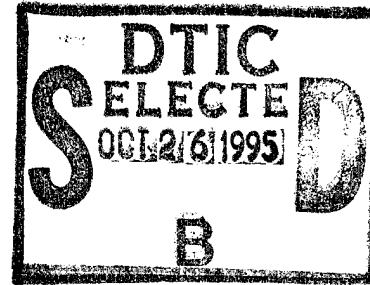




Carnegie-Mellon University
Software Engineering Institute

**Special Report
CMU/SEI-95-SR-011**

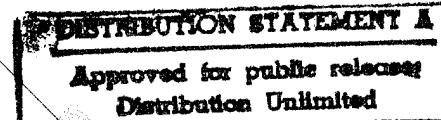


**Directory of Industry
and University Collaborations
with a Focus on
Software Engineering Education**

Maribeth B. Carpenter

Version 3

September 1995

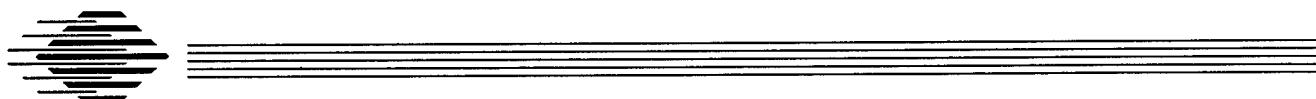


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Special Report
CMU/SEI-95-SR-011

Version 3, September 1995

Directory of Industry and University Collaborations with a Focus on Software Engineering Education



Maribeth B. Carpenter

Community Sector

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Software Engineering Institute
Carnegie Mellon University
Pittsburgh, Pennsylvania 15213

This report was prepared for the

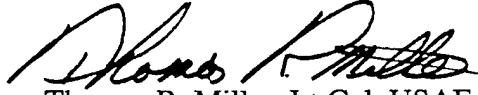
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The ideas and findings in this report should not be construed as an official DoD position. It is published in the interest of scientific and technical information exchange.

Review and Approval

This report has been reviewed and is approved for publication.

FOR THE COMMANDER



Thomas R. Miller, Lt Col, USAF
SEI Joint Program Office

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Table of Contents

Introduction	1
Geographical Data	3
Alliance for Higher Education	5
California State University, Long Beach Software Engineering Forum for Training	7
Computer Applications and Software Engineering (CASE) Center at Syracuse University	9
Consortium for Graduate Education in Software Engineering (ConGESE)	11
D.C. SPIN Training Group	13
Florida Atlantic University	15
Quebec Master's Program in Software Engineering	17
Research Institute for Computing and Information Systems (RICIS)	19
San Diego State University Center for Computer Technology	21
Software Industry Coalition	23
Software Productivity Centre	25
Software Quality Institute	27
Software Quality Research Laboratory (SQRL)	29
Software Technology Centre	31
The University of British Columbia Certificate in Software Engineering	33



The University of Southern California Center for Software Engineering 35

Bibliography 37

Directory of Industry and University Collaborations with a Focus on Software Engineering Education

Abstract: This directory describes collaborative efforts to promote software engineering education among businesses and universities in the United States and Canada. The groups vary in their maturity and the services they provide. The reader can use this directory to find collaborations that match their needs and are located within their geographic area.

Introduction

This directory contains information on collaborative efforts to promote software engineering education, usually within a specific geographic area. It allows the reader to locate an existing group with which to interact as a potential member, supporting university, or commercial provider of educational services. The directory provides brief descriptions of currently identified collaborations. It is expected that the directory will grow as more such collaborations are formed and identified.

The groups described vary in their maturity and in the type of services they provide. Some groups merely share information and experience; others offer software engineering classes to members and non-members for a fee. Obtaining cost-effective education designed to specification and delivered locally is often difficult for a single organization, but when organizations pool resources and share classroom seats, costs go down. A nearby university typically serves as the group facilitator and coordinates class offerings. These offerings may be selected by a refereed process from course proposals solicited from educational vendors.

For a software organization, the directory provides an awareness of geographically convenient collaborations. If none are available locally, the descriptions of existing collaborations may serve as a model for the formation of a local group. The more mature groups are serving as models to emerging groups, providing examples of organization structure, charters, fee arrangements, and other pertinent information.

For colleges and universities, the directory highlights a potential business opportunity and a way to become more involved in the local industrial community. The points of contact from universities are experts in techniques for organizing local efforts.

For educational providers, the directory can serve as a pointer to new potential client bases.

A short bibliography is provided to point the reader to background material on software engineering curricula, coalitions in other countries, software process improvement networks (SPINs), and the Capability Maturity Model (CMMSM), developed by the SEI, and its key process areas (KPAs). These topics are relevant to the discussion of the goals of the collaborations.

Geographical Data

The following lists indicate by state or province where the university and industry collaborations described in this directory are located.

British Columbia

Software Productivity Centre (page 25)

The University of British Columbia Certificate in Software Engineering (page 33)

California

California State University, Long Beach Software Engineering Forum for Training (page 7)

San Diego State University Center for Computer Technology (page 21)

Software Industry Coalition (page 23)

The University of Southern California Center for Software Engineering (page 35)

District of Columbia

D.C. SPIN Training Group (page 13)

Florida

Florida Atlantic University (page 15)

New York

Computer Applications and Software Engineering (CASE) Center at Syracuse University (page 9)

Ontario

Consortium for Graduate Education in Software Engineering (ConGESE) (page 11)

Quebec

Quebec Master's Program in Software Engineering (page 17)

Saskatchewan

Software Technology Centre (page 31)

Tennessee

Software Quality Research Laboratory (SQRL) (page 29)

Texas

Alliance for Higher Education (page 5)

Research Institute for Computing and Information System (RICIS) (page 19)

Software Quality Institute (page 27)

Alliance for Higher Education

The Alliance for Higher Education creates partnerships between academic and corporate communities to respond to the educational demands of business, industry, and government and to facilitate cooperative activities. It began its mission in 1967 with The Association for Graduate Education and Research (TAGER) television network, which brings higher education to the workplace. The Dallas chapter of the software process improvement network (SPIN), in conjunction with the Association for Software Engineering Excellence (ASEE), is working to provide software engineering education over the TAGER network.

Organization

The Alliance for Higher Education is a not-for-profit, non-government agency. It is directed by a board of trustees. Presidents and chancellors of member academic institutions provide direction through the Council of Presidents.

Membership

There are three categories of membership:

1. Principal participants are colleges and universities, currently numbering about 25.
2. Associate participants are institutions, agencies, or companies that are substantial users of Alliance services.
3. Service subscribers participate in Alliance services.

All membership categories have a membership approval process. There is a fee structure for membership.

Course Acquisition

Influenced by both the Dallas SPIN and SEI curriculum guidelines, Southern Methodist University, Texas Christian University, and The University of Texas at Arlington offer graduate courses in software engineering over the TAGER network. The Alliance produces a course catalog.

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California State University, Long Beach Software Engineering Forum for Training

Formed in September 1993, the California State University, Long Beach (CSULB) Software Engineering Forum for Training (SEFT) is a training partnership among companies in the Long Beach, Los Angeles, and Orange County areas. CSULB SEFT provides high-quality, cost-effective, tailored training in software engineering process improvement and management practices to employees of member companies. Membership in the consortium provides the opportunity to influence and guide the training curriculum. Membership fees are applied directly to the training that companies receive.

Organization

SEFT has an advisory executive board and a technical committee composed of member and CSULB representatives. The Executive Board is the policy-making body, and the Technical Committee develops curricula and assists the board. SEFT is administered by the Division of Professional Development, University College and Extension Services, and has a charter and documented operating plan.

Membership

Members of SEFT include McDonnell Douglas, Northrop Grumman Corporation, and TRW. Funding of SEFT is provided through the sale of annual memberships. Members have seats on the Executive Board and the Technical Committee, priority access to training at a reduced cost, direct input into the selection of course topics and curriculum, and discounts on selected non-credit University College and Extension Services courses.

Course Acquisition

Following a thorough needs assessment, course topics are identified and detailed course outlines are written. Potential instructors and faculty are solicited to begin customization of courses. SEFT has access to an in-house training consultant for curriculum design and development.

Several courses have been delivered. Subject areas include software configuration management, software metrics, software testing, software risk analysis and management, and topics related to software process improvement. Courses are open to the public when space is available. CSULB SEFT has extensive mechanisms, such as videoconferencing, for delivering distance education.

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Computer Applications and Software Engineering (CASE) Center at Syracuse University

The Computer Applications and Software Engineering (CASE) Center at Syracuse University is one of New York State's original Centers for Advanced Technology (CATs). Initiated in 1983, the CAT program represents a creative partnership among universities, industry, and government designed to accelerate the development of commercially relevant technologies. Key goals are increased industrial productivity, a strengthened technological infrastructure, and more effective technology transfer — all helping to spur economic growth.

Organization

The CASE Center is managed by its director, Bruce Berra, and its research director, Robert Birge. Faculty researchers, university administrators, and CASE staff assist the directors with industrial liaison, technology transfer, and outreach programs. More than 60 faculty members from a dozen academic departments and campus organizations are affiliated with the center. The CASE Center's research program emphasizes four major technical areas: software engineering research, computer-aided design, distributed information systems (emphasizing multimedia), and scientific modeling. Each area involves development and enhancement of computer software. The Software Engineering Program focuses specifically on developing tools and methods for improving the quality of software through such techniques as software metrics and formal methods, object-oriented methods, neural networks, associative processing, and parallel software. The center operates several specialized laboratories, including the Software Engineering Lab and Open Systems Cluster, that support research, technology transfer, and advanced training activities. Research results are disseminated through conferences, workshops, seminars, demonstrations, and special events. Publications include technical reports, a newsletter, and informational materials.

Membership

In addition to federal grants and seed funding from the New York State Science and Technology Foundation, the CASE Center has received funding from over 100 companies, universities, and government organizations, the majority of them operating within New York. The center conducts joint research with industry and other outside sponsors. Through the Industrial Membership Program, partners receive invitations to workshops and conferences, special assistance, and representation on an advisory board. The center also provides technical consulting, access to computer facilities and special information systems, laboratory interactions, and specific technical services.

Course Acquisition

The CASE Center offers a variety of educational opportunities for both college students and corporate personnel. Dozens of qualified graduate students are supported on research assistantships every year and company employees enrolled in graduate degree programs frequently participate in collaborative research with CASE faculty. To introduce the most recent scientific advances to the commercial sector, the center regularly sponsors short courses, tutorials, and other technical sessions targeted to business and industry. Laboratories provide hands-on training and practical applications of theoretical concepts.

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Consortium for Graduate Education in Software Engineering (ConGESE)

ConGESE provides education specially structured for software professionals in Ontario industries, leading to a master's degree in computer science, with an emphasis in software engineering. Each of six participating universities offers courses in this program. The courses are typically offered on-site with cooperating industrial sponsors and are designed for the working professional, who might otherwise find it difficult to attend regular, on-campus graduate programs. ConGESE is responsible for maintaining the curriculum and administering the program and course delivery. Degree granting rights rest with the participating universities.

Organization

ConGESE is governed by a committee structure composed of the Executive Board, Academic Steering Committee, and Industry Steering Committee. Curriculum issues are handled by the Curriculum Committee. Additionally there is a Technology and Continuing Education Committee and a Promotion and Funding Committee. Committee responsibilities are shared across the participating universities and companies. Further information on ConGESE is available from the World Wide Web: <http://www.turing.toronto.edu/~congese>.

Membership

The universities participating in ConGESE are all those that grant PhD degrees in computer science in Ontario.

- Carleton University
- Queen's University
- University of Ottawa
- University of Toronto
- University of Western Ontario
- University of Waterloo

Industrial participation started with the substantial support of the IBM Toronto Laboratory and Bell Northern Research Ltd. The ConGESE program is financially supported by the Information Technology Research Centre, an Ontario Centre of Excellence.

Course Acquisition

Four areas make up the technical core of software engineering courses.

- requirements and specification
- architecture and design
- reuse and maintenance
- verification and testing

Other areas round out the coverage of software engineering.

- application classes and support software technology
- management of people, products, projects, and processes

Point of Contact for Further Information

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D.C. SPIN Training Group

The Washington, D.C., Software Process Improvement Network (SPIN) started a training group in early 1993. This special interest group meets monthly, usually the third Wednesday night of the month, from 7:00-8:00 p.m., followed by a half-hour informal networking session.

Organization

The D.C. SPIN Training Group has drafted a charter that includes both training and education goals. At the moment, the organization is run by a loose association of volunteers. Meetings usually feature speakers who share information about their organizations' training programs, recap pertinent presentations from national conferences, or describe available training.

Membership

Members are drawn from the D.C. SPIN. There are approximately 75 members. Attendance at meetings ranges from 10 to 15 people. Individuals may request that they be added to the training group mailing list to receive announcements and minutes of meetings.

Course Acquisition

To date, the D.C. SPIN Training Group has not acquired any classes for its members. It did, however, send students to a pilot offering of an SEI course.

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Florida Atlantic University

The Florida Atlantic University (FAU) Computer Science and Engineering (CS&E) Department and members of its Industry Advisory Committee recognized a need to establish an extensive graduate education effort in software engineering. Through a combination of SEI-produced video presentations and FAU-produced live lectures, a series of six graduate-level software engineering courses was offered consecutively at six university and industry sites in southeast Florida during 1990 and 1991, and in a limited fashion until April 1993. The courses were fully funded by the participating industries. On January 16, 1992, 59 students were awarded certificates in software engineering for successfully completing at least 5 of the 6 courses. By the spring of 1993 term, over 250 students had taken at least one course.

Since this successful program, FAU has expanded its internal offerings through the statewide Florida Engineering Educational Delivery System (FEEDS). Through FEEDS, courses are offered by videotape and live broadcast and in standard lecture format to subscribing sites and on-campus students.

Beginning in 1995, the FAU CS&E Department approved and implemented a software engineering option within its existing master's programs. Many of the courses are offered through FEEDS.

Organization

The FAU CS&E Department formed the Industry Advisory Committee to help the department identify and meet the needs of the large computing-based industry in southeast Florida. During the advisory committee's initial meetings, the need for extensive graduate software engineering courses for employees quickly emerged as the top issue. While FAU offered software engineering courses as part of its graduate programs, it was not prepared to offer the variety and number of courses that were needed immediately without more financial assistance and faculty. FAU contracted with the SEI to obtain a set of video-based courses to be delivered by FAU faculty.

Membership

Nine research and development firms having headquarters or major plants in southeast Florida were invited to join the FAU CS&E Department Industry Advisory Committee: Bendix King, Encore Computer Corporation, Harris, IBM, Modular Computer Systems, Motorola, Siemens Stronberg-Carlson, Racal-Milgo, and United Technologies. These companies fully funded the courses taught between 1990 and 1993 in the graduate software engineering education program.

Course Acquisition

The courses taught between 1990 and 1993 in association with the SEI were Software Project Management, Software Verification and Validation, Software Design, Software Creation and Maintenance, Software Specification, and Software Systems.

During the 1994-95 academic year, FAU offered courses in Object-Oriented Software Design, Software Engineering Measurements, Software Engineering (a survey), and Advanced Object-Oriented Software to employees at industries including Harris, IBM, Motorola, Racal-Milgo, and Siemens, as well as to on-campus students.

FAU now offers a software engineering graduate specialty track in the MCS and MSCS programs. Students must take at least two courses from each of the groups shown below, as well as additional course and thesis work.

Group 1: Fundamentals

- Object-Oriented Software Design
- Formal Aspects of Computer Science and Engineering
- Software Testing
- Software Requirements Engineering

Group 2: Development

- User Interface Design
- Computer-Aided Software Engineering
- Formal Methods
- Advanced Topics in Object-Oriented Design

Group 3: Quantitative and Experimental

- Software Engineering Measurements
- Software Reliability Engineering
- Model Based Simulation
- Computer Performance Modeling

Point of Contact for Further Information

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Quebec Master's Program in Software Engineering

The Quebec software engineering program provides education specially structured for software professionals in Quebec, leading to a master's degree in computer science, with an emphasis in software engineering. Each of seven participating schools offers courses in this program.

Organization

Each educational partner designates a professor to specialize in software engineering and to coordinate the program at his school. This professor represents his school on a coordination committee that determines the courses to be offered in the program, student admission requirements, and the criteria for granting degrees. The coordination committee establishes the membership of a business and industry committee that advises on the applicability of the program to their working environments and guides the evolution of the program.

Membership

The educational partners participating in the master's program in software engineering in Quebec are

- L'École Polytechnique de Montréal
- L'École de Technologie Supérieure
- L'Institut National de Recherche Scientifique
- L'Université Concordia
- L'Université de Sherbrooke
- L'Université du Québec à Montréal
- L'Université Laval

Course Acquisition

To complete the program, the student must earn 45 credit units, equally distributed over

- a foundations module
- an area of specialization
- an integrated learning experience composed of courses, an optional case study, and a project requiring at least 27 hours per week. The courses focus on topics such as data representation, expert systems and artificial intelligence, system security, parallel systems, and object-oriented approaches.

Point of Contact for Further Information

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Research Institute for Computing and Information Systems (RICIS)

The mission of RICIS is to provide a setting for interdisciplinary research coalitions to explore computing technology and corresponding implications for an information-driven civilization. RICIS provides the research evaluation and advocacy needed to build coalitions and partnerships to match new and promising technologies with challenging problems dealing with complex, computing-based systems for the benefit of the university, NASA, and the general public.

Emphasized research areas include software reuse, group decision support methodology, mission- and safety-critical systems, and medical imaging. New projects are being formed in digital libraries, environmental computing, and network information resources. Special emphasis is placed on design and execution of symposia, projects, and interchanges to facilitate technology transfer among RICIS participants.

Organization

The University of Houston at Clear Lake (UHCL) established RICIS in 1986 to encourage the NASA Johnson Space Center (JSC) and local industry to actively support research in computing and information systems. A cooperative agreement between UHCL and NASA/JSC provides for sharing of personnel and computing and educational facilities. The RICIS Program Office in the UHCL Provost Office, manages funding from various sources, primarily from NASA under the cooperative agreement. The overall organization is that of collaborative projects within the above broad research areas.

Membership

RICIS encourages faculty participation across UHCL schools: Natural and Applied Sciences, Business and Public Administration, Human Sciences and Humanities, and Education. An industrial affiliates program involves local companies (led by Rockwell, Lockheed, UNISYS, McDonnell Douglas, Loral/IBM, and Texaco) in defining research problems in systems engineering and project management. A gateway concept expands the local expertise on targeted problems to include vendors, other universities, and other research organizations. Fees are charged only for direct participation in projects.

Course Acquisition

Courses and special events are organized in conjunction with the UHCL Professional and Continuing Education unit. A master of software engineering degree program is offered within the Computer Science Program. Related programs are available in business administration, futures studies, and instructional technology, among others. Further description of the institute, its research areas, and the Master of Software Engineering Program are available on the World Wide Web at <http://ricis.cl.uh.edu>.

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San Diego State University Center for Computer Technology

The San Diego State University (SDSU) Center for Computer Technology (CCT) is a partnership of San Diego industry, corporations, interested government organizations, and SDSU. The center is a self-supporting unit that draws on existing activities and resources provided by local business, government, and SDSU. The Center for Computer Technology promotes high-quality, cost-effective training in software engineering and management practices. The purpose of this training is to empower members to build and implement a process infrastructure for effective software engineering and management practices to support the goal of achieving higher software process maturity levels as defined by the Software Engineering Institute (SEI), Carnegie Mellon University.

Organization

The CCT has an advisory executive board composed of member and SDSU representatives. The CCT Technical Steering Committee, through subcommittees, manages the activities that meet the technical needs of the CCT, such as curriculum development and course selection. The CCT director is part of SDSU Professional Development, College of Extended Studies. The CCT has a charter and documented operating plan.

Membership

Thirteen companies are currently enrolled in CCT. Most are Department of Defense contractors, some large, some small. Funding of CCT is provided through the sale of annual memberships. The level of membership determines the membership fee and the annual seat allocation in CCT course offerings.

Course Acquisition

Following a curriculum needs assessment, seminar topics are selected and course descriptions are written. Proposals are solicited from potential instructors. Since 1992, 30 courses have been delivered. Courses are open to non-members for a fee.

Point of Contact for Further Information

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Software Industry Coalition

Established in the spring of 1993, the Software Industry Coalition is a non-profit, mutual benefit corporation dedicated to improving the effectiveness of the software industry's relationships, workforce, processes, and products. The mission of the Software Industry Coalition is to identify significant software industry issues, act as a catalyst in resolving those issues, and present a coordinated industry voice.

Organization

The Software Industry Coalition is led by its board of directors, which is composed of member representatives. It is managed by a small executive staff. Coalition members and staff have identified projects and working groups that are of interest, for example:

- The Software Skills Upgrade Project (SSkillsUP) is designed to create a software-competent workforce that is supported and trained through extensive partnerships among industry, educational organizations, and government.
- The Software Process Group shares best practices in software development process.
- The Information Systems Group shares best practices in information systems management.
- The coalition has researched and published the Software Creator's Profiler as a tool for managers, human resources professionals, and software professionals to assess the skills and training requirements for any software creator's job. This is an ongoing project examining the underlying skills required of software creators.
- The coalition co-sponsored a labor market study of employment practices for software creators. The study shows the systemic relationships among employers, educators, and career facilitators.
- The Intellectual Property Committee provides forums to educate members on the consequences of legislative activity and assist in developing a consensus on the issues.

Membership

Members reflect the diversity of the software industry: independent software vendors, government laboratories, universities and colleges, and computer manufacturers. Membership fees support the work of the projects.

Course Acquisition

In collaboration with universities, consultants, and corporate education teams, the Software Industry Coalition develops focused, timely, and effective technical education and training programs that ensure implementation of sound product development and management process-

es. Success is measured in part by the development and delivery of multiple workshops, courses, and curricula to meet the identified needs of the industry on an ongoing basis.

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Software Productivity Centre

The Software Productivity Centre (SPC) is a technical resource centre for software developers. As a non-profit organization, its activities are driven by the needs of its members. The SPC collaborates internationally with other organizations to offer solutions to technical problems. To assist software development companies in the improvement of their software engineering process, the SPC offers training, SEI assessments, and a family of products.

Further information on the SPC is available on the World Wide Web at <http://www.spc.ca/spc/>.

Organization

Since its establishment in 1992, the SPC has grown to include over 100 corporate members in Canada, the U.S., and other countries. The centre is led by a board of directors consisting of representatives from the software industry and universities. SPC is supported by government funding and contributions from 50 sponsors. The centre currently employs eight full-time staff and several contractors.

Membership

The SPC provides valuable services to over 5,000 software professionals within 120 companies. For an annual fee, members receive discounts on training courses, products, and other related services. Membership categories are available for regional, national, and international members. Members gain valuable knowledge and time-sensitive information by utilizing SPC consultation and technology transfer services. Special interest groups, such as the ISO Consortium, provide a forum for members to exchange ideas, discuss current issues, and share learning experiences.

The SPC offers modified SEI assessments which target small- and medium-sized organizations. SPC tools are designed for improved productivity and better control of the development process. The current family of tools includes documentation templates, ISO 9000 templates, a software metrics tool, and a SEI assessment tool.

Members receive monthly issues of *Tech News*, a newsletter that provides technical information. The *SPC Update* is a quarterly newsletter that provides details on upcoming events within the SPC, current issues of the industry, and information on related organizations.

Course Acquisition

The focus of SPC is to supply practical assistance to software developers. The SPC offers a complete program of software engineering courses, including:

- Process Improvement
- Software Project Management
- Software Quality Assurance and Testing
- Configuration Management
- Requirement Analysis
- ISO 9000

Seminars focus on technology-specific topics and feature reputable local and international speakers. Monthly seminars feature industry representatives, who speak about their experiences with process improvement initiatives. SPC also organizes an annual software practitioner's conference, with presentations on technical and managerial software engineering experiences.

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Software Quality Institute

The Software Quality Institute (SQI) is a multidisciplinary partnership between The University of Texas at Austin and the software and information systems organizations in Texas. Its mission is to inform and educate software producers and software users at the local, state, and national levels about issues vital to the production and application of high-quality software. SQI draws upon the wealth of research and expertise available at UT-Austin as well as from a large pool of outstanding talent from industry and government.

Further information on the SQI is available on the World Wide Web at
<http://ceswww.utexas.edu/sqi/>.

Organization

SQI is guided by an advisory group of 28 representatives from industry and government who assure that SQI activities meet industry needs, including program development and curriculum selection. Subcommittees oversee other SQI activities, which include publication of *Software Quality Matters*, a quarterly newsletter; Austin Software Executives' Group (ASEG), which brings together key executives to discuss business issues; and the Austin Software Process Improvement Network (A-SPIN), which sponsors monthly meetings for developers and managers.

Membership

SQI is a resource recovery program that receives funding from registration fees, individual memberships, corporate support, and subscriptions. Training is offered through public programs as well as courses that are taught on-site. Programs currently underway include a 13-month Software Project Management Certificate Program, one- and two-day seminars, and a series of half-day presentations for executives with oversight responsibility for managing software divisions.

Course Acquisition

SQI programs are offered to professionals on a non-credit basis and topics are selected according to assessments. Proposals are solicited from potential instructors. Subject areas include software project management, risk management, in-process inspections, testing, human-computer interfaces, process, configuration management, and related topics.

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Software Quality Research Laboratory (SQRL)

The University of Tennessee Software Quality Research Laboratory (SQRL) does applied software engineering research and technology transfer. The primary emphasis in the research program is improving the current state of software engineering practice through application of fundamental mathematical and statistical methods and classical engineering practices. The technology transfer program takes the form of process consultation, tailored training, and demonstration projects.

Unique aspects of SQRL capabilities are

- The use of the Cleanroom software engineering process as a framework for integrating all technology advances.
- An interest in synergy between the research program and technology transfer activities via partnerships to address new problems.
- A "just-in-time" training approach based on the application project schedule.
- The ability to draw on other University of Tennessee resources in the Computer Science department and the College of Engineering.
- An approach to process definition, control, and improvement that has matured through use in 15 in-house Cleanroom development projects since 1988.

Further information on the SQRL is available on the World Wide Web at
<http://www.cs.utk.edu/~spowell/sqrl.html>.

Organization

The SQRL is the center of software engineering emphasis in the University of Tennessee Department of Computer Science. Participants include faculty, students at all academic levels, and associates from other areas of the university as needed for specific projects.

Membership

The SQRL has individual partnerships with corporations interested in software engineering support. Industrial partners have included

- Bell Northern Research
- Computer Technology and Imaging
- IBM Raleigh Laboratory
- IBM Westlake Laboratory
- Martin Marietta Energy Systems
- Norhem Telecom
- Software Engineering Technology

Course Acquisition

Academic courses are offered at the university; tailored industrial training and consultation is offered at sponsor sites.

Academic courses in software engineering are offered at the BS, MS, and PhD levels. Many students are full-time employees from area corporations. During 1994-1995, the SQRL developed a new academic course under US Air Force sponsorship named Statistical Methods and Stochastic Processes in Software Engineering.

Industrial short courses and long-term training in software management, specification, development, and certification have been provided for industrial partners. The SQRL conducts all training on a "just-in-time" basis, within the context of the specific project environment and application. Consultation throughout the project is provided through on-site conferences, video conferences, telephone conferences, and electronic mail. Consultation is an important aspect of the University of Tennessee SQRL approach; all project work products are reviewed during the initial application of new methods.

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Software Technology Centre

The Software Technology Centre (STC) is an industry-led, strategic alliance with post-secondary educational institutions and the Saskatchewan and Canadian governments. Established in December 1993, the STC is a not-for-profit corporation, whose mission is "to assist the software community to be globally competitive" with the goal of stimulating the development of a strong private sector. To fulfill this mission and to meet members' and stakeholders' needs, the STC offers services in professional development, information collection and dissemination, and strategic development. STC services complement, not compete, with industry.

The STC goal is to become an internationally recognized information technology centre. It acts as a catalyst to assist members and stakeholders in global competitiveness; to deliver quality services to meet customers' evolving needs; to advocate the value of information technology; and to transfer world-class, state-of-the-art information technology knowledge, including software engineering principles and practices, to other economic sectors.

The STC provides over 35 courses per year:

- executive seminars, e.g., on the implementation of process improvement
- software management programs, with a focus on process improvement and modern methods of defining and managing software development projects
- emerging technology programs
- network communications programs

Organization

The STC is led by a board of directors that is chaired and controlled by industry. Educational institutions and governments have seats on the board. Some notable STC founding members are Information Systems Management (ISM) Corporation (a subsidiary of IBM), CDSL Canada, Saskatchewan Telecommunications, and SED Systems. They are joined by about 30 other organizations, many of whom are local small-to-medium sized information technology firms. In addition to these individual member organizations, two other major associations have joined the STC: the Software Development Association of Saskatchewan, which has over 50 small firms as members; and over 300 information technology practitioners who are members of the Canadian Information Processing Society chapters in Saskatchewan. The STC has a strong educational membership base; the Universities of Regina and Saskatchewan and the Saskatchewan Institute of Applied Science and Technology are full members.

The STC has formed a number of Canadian and international strategic alliances which contribute significantly to its ability to serve the needs of its members.

- The Software Process Improvement and Capability Determination (SPICE) Program, of which the STC is a member, is under the auspices of the International Standards Organization. With participants from about 20 countries, SPICE focuses on making software process improvement methods more widely used. The STC will coordinate the SPICE trials in the Canadian Prairie region.

- The European Software Institute (ESI), with which the STC has a formal cooperation agreement, provides the STC with the means to learn from major software engineering programs in the European Union. The ESI, located in Bilbao, Spain, is the major software engineering centre of the European Union.
- The Information Technology Association of Canada (ITAC), of which the STC is a regional affiliate, is the major national information technology association in Canada. The STC is the only member of the ITAC board of directors representing the Canadian Prairie region.

The centre consists of a small professional staff, which is routinely supplemented by contracted, private sector, and educational institution staff.

Membership

Annual membership fees entitle members to directly influence STC strategy, to receive discounts on services, and to benefit from synergy with other members. Members are always given priority access to services. Close, ongoing dialogue with members and clients is a key element in STC operations. These exchanges help the STC define its current and planned service offerings and to ensure that the STC continually meets the emerging needs of the software and information technology community.

Course Acquisition

STC professional development programs emphasize solutions to the unique needs of two major organizational groups: MIS in-house organizations in both the private and the public sector and small-to-medium enterprises who are primarily software developers and system providers. The STC chooses its courses using the guidance of an advisory committee drawn from the software community. Key programs to be offered in 1996 include courses on executive-level awareness, software engineering, object-oriented methodologies, databases, and client-server networks. The STC is committed to the effective development and use of distance training technologies and methodologies.

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The University of British Columbia Certificate in Software Engineering

Introduced in September 1995, the Certificate in Software Engineering Program at The University of British Columbia (UBC) will serve the professional development needs of information systems and software professionals in British Columbia and beyond. The program was developed with the input of local and provincial industry, and includes partnerships in curriculum development and teaching expertise.

Organization

The growing need for professional development in the software engineering field led to the development of a proposal in September 1994 for a Certificate in Software Engineering. Consequently, Continuing Studies at UBC founded an advisory committee with representatives from relevant academic units and industry representatives.

- Centre for Integrated Computer Systems Research (UBC)
- Continuing Studies (UBC)
- Continuing and Distance Education for Engineering and Architecture (UBC)
- Department of Computer Science (UBC)
- Department of Electrical Engineering (UBC)
- Hughes Aircraft of Canada Ltd.
- Newnes Machines Limited
- Software Productivity Centre

With the guidance of the advisory committee, a needs and demand assessment was conducted, including interviews with local industry representatives, the distribution of surveys to prospective students, and research into existing programs and curricula. The majority of courses for the program are new offerings, but some current offerings of the Software Productivity Centre have also been incorporated into the program. The program will be administered by UBC Continuing Studies.

Membership

The Certificate in Software Engineering Program is offered in a format compatible with the needs of local industry and will eventually serve the needs of companies located outside the Vancouver area. The program is also open to individuals who are not currently employed in the software industry or who may be seeking a change of career. Applicants to the program who do not have prior knowledge in programming, formal mathematical methods, and computer systems will be required to complete prerequisite courses.

Course Acquisition

The certificate requires a minimum of 80 hours from the following core courses:

- Software Process Engineering I, II, and III (20 hours each)
- Requirements for Software Specification (10 hours)
- System and Software Testing (10 hours)
- System and Software Design and Implementation (10 hours)
- Software Engineering Team Project Orientation (5 hours)
- Software Engineering Independent Case Study (10 hours)

The certificate requires a minimum of 70 hours from the following elective courses:

- Object-Oriented Techniques (5 hours)
- Costing Software (5 hours)
- Software Tendering: Preparing Contract Bids (5 hours)
- Software Quality (5 hours)
- Software Documentation (5 hours)
- Software Maintenance (5 hours)
- Modeling and Analysis of Computer Systems (10 hours)
- Software Development Tools (5 hours)
- Computer Human Interfaces (10 hours)
- Database Design (10 hours)
- Programming Language Issues (10 hours)
- Operating System Issues (10 hours)
- Formal Methods (10 hours)
- Embedded, Real-Time Systems (10 hours)
- Software Safety (10 hours)

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The University of Southern California Center for Software Engineering

The University of Southern California (USC) Center for Software Engineering (CSE) has been formed to develop more mature software engineering organizations to meet the demand for complex software systems of the future. "Its bottom-line objective is to improve the long-range state of software engineering practice by catalyzing a new generation of software engineering courseware and delivery capabilities. Its 10-year strategy for achieving this objective involves a combination of sustained programs in software engineering education, research, and technology transition" (from the Prospectus for the USC Center for Software Engineering Affiliates' Program, December 1992).

Organization

The USC CSE takes a multifaceted approach to improving the state of software engineering practice. It performs necessary gap-filling research in such areas as knowledge-based software engineering, environments, processes, architectures, and economics. In the fall of 1993, it initiated an MS in computer science with a software engineering specialization. It has plans to develop textbooks, videos, computer models, games, tools, exercises, and role-model artifacts for training the next generation of software engineers. The USC Center for Software Engineering has an affiliates program with an active Affiliates' Steering Committee. The CSE director is part of the USC Computer Science Department; the center principals include USC professors in electrical engineering and business, and professors at the USC Information Sciences Institute.

Membership

Industry and government affiliates are a key aspect of the CSE. Through payment of an annual membership fee, affiliates acquire a seat on the Affiliates' Steering Committee. Center personnel provide an annual one-day visit to the affiliate organization, involving a professor and an agenda of the affiliate's choice. Affiliates participate in focused workshops, executive software seminars, and an annual software engineering conference and monthly software process improvement network (SPIN) meetings in collaboration with University of California Irvine. Affiliates receive prototype tools for experimentation, technical reports, and exploratory videos and courseware. There are currently 25 affiliate organizations.

Course Acquisition

While the center does not produce courses specifically for affiliates, member organizations benefit from annual one-day USC professor lectures and visits to the affiliate's organization. Periodic focused workshops provide the opportunity for technical interchange among professors, researchers, and practitioners. Most of the software engineering MS courses are offered

on a regional interactive television network; some of the courses are also offered nationally by the National Technological University.

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REPORT DOCUMENTATION PAGE

1a. REPORT SECURITY CLASSIFICATION Unclassified		1b. RESTRICTIVE MARKINGS None					
2a. SECURITY CLASSIFICATION AUTHORITY N/A		3. DISTRIBUTION/AVAILABILITY OF REPORT Approved for Public Release Distribution Unlimited					
2b. DECLASSIFICATION/DOWNGRADING SCHEDULE N/A							
4. PERFORMING ORGANIZATION REPORT NUMBER(S) CMU/SEI-95-SR-011		5. MONITORING ORGANIZATION REPORT NUMBER(S) N/A					
6a. NAME OF PERFORMING ORGANIZATION Software Engineering Institute	6b. OFFICE SYMBOL (if applicable) SEI	7a. NAME OF MONITORING ORGANIZATION SEI Joint Program Office					
6c. ADDRESS (city, state, and zip code) Carnegie Mellon University Pittsburgh PA 15213		7b. ADDRESS (city, state, and zip code) HQ ESC/ENS 5 Eglin Street Hanscom AFB, MA 01731-2116					
8a. NAME OF FUNDING/SPONSORING ORGANIZATION SEI Joint Program Office	8b. OFFICE SYMBOL (if applicable) ESC/ENS	9. PROCUREMENT INSTRUMENT IDENTIFICATION NUMBER F19628-95-C-0003					
8c. ADDRESS (city, state, and zip code)) Carnegie Mellon University Pittsburgh PA 15213		10. SOURCE OF FUNDING NOS. <table border="1" style="width: 100%;"><tr><td>PROGRAM ELEMENT NO 63756E</td><td>PROJECT NO. N/A</td><td>TASK NO N/A</td><td>WORK UNIT NO. N/A</td></tr></table>		PROGRAM ELEMENT NO 63756E	PROJECT NO. N/A	TASK NO N/A	WORK UNIT NO. N/A
PROGRAM ELEMENT NO 63756E	PROJECT NO. N/A	TASK NO N/A	WORK UNIT NO. N/A				
11. TITLE (Include Security Classification) Directory of Industry and University Collaborations with a Focus on Software Engineering Education							
12. PERSONAL AUTHOR(S) Maribeth Carpenter							
13a. TYPE OF REPORT Final	13b. TIME COVERED FROM TO	14. DATE OF REPORT (year, month, day) September 1995	15. PAGE COUNT 38 pp.				
16. SUPPLEMENTARY NOTATION							
17. COSATI CODES		18. SUBJECT TERMS (continue on reverse if necessary and identify by block number) businesses and universities, U.S. and Canada collaborations software engineering education					
19. ABSTRACT (continue on reverse if necessary and identify by block number) <p>This directory describes collaborative efforts to promote software engineering education among businesses and universities in the United States and Canada. The groups vary in their maturity and the services they provide. The reader can use this directory to find collaborations that match their needs and are located within their geographic area.</p>							
(please turn over)							
20. DISTRIBUTION/AVAILABILITY OF ABSTRACT UNCLASSIFIED/UNLIMITED <input checked="" type="checkbox"/> SAME AS RPT <input type="checkbox"/> DTIC USERS <input checked="" type="checkbox"/>		21. ABSTRACT SECURITY CLASSIFICATION Unclassified, Unlimited Distribution					
22a. NAME OF RESPONSIBLE INDIVIDUAL Thomas R. Miller, Lt Col, USAF		22b. TELEPHONE NUMBER (include area code) (412) 268-7631	22c. OFFICE SYMBOL ESC/ENS (SEI)				